Mentoring

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Mentoring: A Review of early career researcher studies

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Abstract

This paper reviews 23 journal articles on 'mentoring' in the context of Early Career Researchers, defined as those in academia with less than 10 years of experience from the start of their PhD. Achieving a better understanding of mentoring is important since within the higher education context new dynamics have created expectations towards more supportive mechamisms for ECRs. In order to better understand the benefits of mentoring for ECRs careers and psychosocial well-being, it is important to understand (1) the core definitions of mentoring used in research, (2) the research methodologies that are applied to research mentoring, (3) the empirical evidence showing the value of mentoring and (4) the remaining gaps for which future research will be needed. Results of the review lead to the following conclusions: there is much research to do, first, to better inform our conceptualization of ECR mentoring and, second, to better understand the value of ECR mentoring support. A research agenda is outlined.

Keywords: mentoring; early career researchers; review paper

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1. Introduction

This paper presents the results of a review of mentoring papers that appeared in leading Higher Education journals in the past ten years. Over the past years, new dynamics have emerged in the context of higher education globally that have created both expectations and aspirations towards supportive mechanisms of early career researchers' (ECRs) professional development. In this paper, ECRs are defined as researchers *in academia* with less than 10 years of experience from the start of their PhD studies, congruent with the definition used by the European Commission.

Why is mentoring an important topic in relation to ECRs? Internationally, ECRs in academia are challenged as regards access to resources, supportive interactions and lack of transparent career prospectives (the European Commision 2011). Related to this is the underlying pressure experienced by ECRs in terms of their opportunities for research and development (Sauermann & Roach, 2012; Åkerlind, 2005; Vitae, 2011) and international mobility (Jepsen et al. 2014; Mellors-Bourne et al., 2013; Kehm, 2007) required to enhance their career prospects and secure stable positions. Moreover, academic workplaces have been transformed; that in turn, has lengthened the learning trajectories of ECRs (Bonetta, 2011) and made them in some respects more complex (Shuster, 2009).

The above reports have pointed out the learning challenges ECRs perceive in developing their intellectual independence and scholarly profiles (Gardner, 2008 for doctoral students; Laudel & Glaser, 2008 for postdocs). These reports also make relatively frequent mention of the value of mentors and mentoring (Mullen & Forbes, 2000; Hemmings, 2012) as do reports of institutional practices to support ECRs (Debowski, 2012). In this context, mentoring broadly can be situated in an array of complex supportive mechanisms including co-working and networking that lead to ECRs' personal development, adaptation and integration as members of their scholarly community (e.g., Baker et al., 2014). On the one hand, this includes informal mentoring through interactions between academics at different career stages. On the other hand, this includes formal mentoring programmes organised and structured at the institutional level.

The role of mentoring in relation to ECRs corresponds to the more general literature on mentoring which focuses on 'career' and 'psychosocial' functions as the two major functions of support between mentors and mentees, contributing to (1) increasing the chances for promotion and higher salaries, building a network of professional collaborators (career function) as well as (2) achieving higher levels of confidence and social skills (psychosocial function) (Ragins & Kram, 2007). Not only the specific function of mentoring, but also the organisation in which mentoring takes place might also have a significant effect on how mentoring is carried out, and which outcomes of mentoring are experienced. It is the specific higher education context we are interested in, and how mentoring gets discussed in the higher education literature as regards ECRs. Four specific aims were formulated for the review.

First of all, we wondered the extent to which ECR mentoring was conceptually constituted since a review on mentoring spanning 30 years of formal mentoring programs in the fields of education, business and medicine (Ehrich et al., 2004) noted the absence of conceptual frameworks. So, we undertook to explore the conceptual tools and definitions used in the post-Ehrich literature on ECR mentoring, starting from 2005. Secondly, not only were we interested in the definitions and conceptual frameworks used by scholars, but we also wished to document the methodological tools they used to measure the impact of their definitions of mentoring.

Thirdly, we also analysed the extent to which empirical evidence would provide insight into how best to support ECRs' development, i.e., what to avoid, since Ehrich et al. (2004) had reported some negative consequences related to, for instance, the lack of training of mentors or mismatch of expertise or personality. There was also some evidence, again from non-higher education contexts (Eby, 2008), that the effects of mentoring could be quite small. This led us to explore the nature of the evidence that would suggest mentoring could be a solution for the existing problems with career development and retention of ECRs, in

particular whether mentoring could be used as a tool that contributes to ECRs' professional development, including their competence (Linden et al., 2013) and professional confidence in a range of key academic practices.

Finally, this review analysis aimed to identify gaps in the current literature and to explore the recommendations scholars have made for future research. In other words, our goal was to provide a research agenda for further inquiry into mentoring in relation to ECRs.

2. Research question

Our overall question was *'What does the ECR literature-research say about mentoring?'* Specific research questions, summarizing the aims in the previous four paragraphs were:

- What is the range of ways in which ECR mentoring is defined or conceptually presented?
- What methodological tools are used, i.e., the range of ways in which mentoring is measured?
- What evidence (or counter evidence) is there of the value of ECR mentoring?
- To what extent does the literature point to future research?

The answers to these questions provided a means to assess the extent to which mentoring was a robust workable construct in examining ECR experience.

3. Method

Scope of review: As we undertook the study, we noted two related fields of study on mentoring, mentioned in the introduction:

- The informal field of learning and acquiring research skills from interactions with more experienced researchers usually working in the same context
- The structured, institutionalized programs of mentoring which are designed to support the needs of special groups like women, newly hired staff, or minority groups if they were directed at ECR.

Search process: In terms of the scope of the review, we decided to include journal articles published in the ISI top ranked Higher Education journals in the past 10 years only (2005-2014) as these are supposed to be the most influential ones in the field. Papers had to be published post-Ehrich review, that is 2004. We reviewed papers that appeared in Higher Education, Journal of Higher Education, Research in Higher Education, Review of Higher Education, and Studies in Higher Education. These journals were likely the ones that HE researchers, developers and policy makers would go to in seeking information about ECR mentoring. We also included the International Journal for Academic Development and International Journal for Researcher Development since these two journals are highly referenced in the field of academic development and thus need to be taken into account in an academic development-related review exercise. While the review has been limited to these journals, we feel confident in having made a sound selection of the major journals in the field.

The keywords 'mentor(ing)' combined with 'early career researchers', 'post-docs', 'doctoral students', and variants had to appear in the title and/or the abstract of the article. We distributed the search task amongst the group of authors, with the search producing 23 papers. The distribution of papers according to journals can be found in Table 1, full references of the 23 papers are included in the reference list at the end of the paper.

Analysis: The analysis framework drew upon Boote and Beile's (2005) literature review scoring rubric, which they developed based on Hart's (1999) previous work. The five review categories Boote and Beile constructed are (1) coverage (reasons for inclusion or exclusion), (2) synthesis (state of the field, ambiguities, new perspectives), (3) methodology (methodologies and research techniques), (4) significance (practical and scholarly significance) and (5) rhetoric (level of coherence and structure). Boote and Beile's work was specifically undertaken to increase scholar's awareness of the literature review stage of a research project and is well-cited.

In order to synthesize the selected literature, we created an Excel file with the following expanded sub-categories of all but the last category in Boote and Beile's (2005) rubric: (1) nature of the article: empirical or theoretical, (2) gap identified by authors, (3) question or purpose of the article, (4) conceptual framework for study, (5) pedagogical intervention (if there was one), (6) data collection method, (7) sample and nature of participants (8) country, disciplines (9) key empirical findings, if any (10) conceptual representation of results (11) practical and pedagogical implications (given our interest in ECR development), (12) suggestions for future research, (13) core references used by authors, and (14) reviewers notes/critique. In general, it can be argued that the sequence from exploring the literature, identifying a gap, spelling out research questions, explaining methodology, explaining and discussing results, and drawing conclusions with recommendations for future policy and practice, is perceived as a standard structure following which social sciences journal articles are written (see Shon, 2012). This structure is also reflected in the sequence of our four research questions, focussing on (1) conceptual frameworks and definitions, (2) methodological approaches, (3) empirical evidence and (4) recommendations for future research.

The articles were distributed across the group of authors. We each read and then summarized the papers; each author separately wrote a description of the emerging findings and his/her interpretation of them. These were used by two of the authors to create a first draft of the findings and conclusions. The draft was then reviewed and edited by the other authors.

Table 1:

Papers included in review (journals listed in alphabetic order)

JOURNAL	YEAR	AUTHORS	TITLE	COUNTRY	ARTICLE KEYWORDS
Higher Education	2014	Lechuga	A motivation perspective on faculty mentoring: the notion of ''non-intrusive'' mentoring practices in science and engineering	US	Faculty Mentoring Motivation Discipline
	2014	van der Weijden, Belder, van Arensbergen & van den Besselaar	How do young tenured professors benefit from a mentor? Effects on management, motivation and performance.	The Netherlands	Mentorship Academic careers Research management Human resources Motivation Performance
	2011	Bell & Treleaven	Looking for Professor Right: mentee selection of mentors in a formal mentoring program.	Australia	Academic development Flexible mentoring Mentor-mentee choice Pairing process
	2011	Lechuga	Faculty-graduate student mentoring relationships: mentors' perceived roles and responsibilities.	US	Faculty Graduate students Mentoring Higher education
	2011	Scaffidi &	A positive postdoctoral	Australia	Postdocs

		Berman	experience is related to quality supervision and career mentoring, collaborations, networking and a nurturing research environment.		Mentoring Collaborations Networking Research environment
International Journal for Academic Development	2012	Saito	When a practitioner becomes a university faculty member: a review of literature on the challenges faced by novice ex-practitioner teacher educators.	-	Professional development Faculty member Ex-practitioner Teacher educator
	2012	Weaver, Robbie, Kokonis & Miceli	Collaborative scholarship as a means of improving both university teaching practice and research capability.	Australia	Academic development Mentoring Scholarship of teaching and learning
	2011	Cox	The impact of communities of practice in support of early-career academics.	US	Early-career academics Academic development program Transformative learning Community of practice Faculty learning community
	2011	Remmik, Karm Haamer & Lepp	Early-career academics' learning in academic communities.	Estonia	Early career academics Professional learning Professional identity Community of practice
	2010	Hubball, Clarke & Poole	Ten-year reflections on mentoring SoTL research in a research-intensive university.	Canada	Mentoring Scholarship of teaching and learning (SoTL) SoTL research outcomes
	2009	Foote & Solem	Toward better mentoring for early career faculty: results of a study of US geographers.	US	Early career faculty Mentoring Doctoral education
	2008	Kamvounias, McGrath-Champ & Yip	'Gifts' in mentoring: mentees' reflections on an academic development program.	Australia	Mentee Mentor Mentoring Gift
	2005	Mathias	Mentoring on a Programme for New University Teachers: A partnership in revitalizing and empowering collegiality.	UK	-
International Journal for Researcher Development	2014	Baker, Pifer& Griffin	Mentor-protégé fit.	US	Mentoring Mentor-protégé fit Doctoral education Student–faculty mentoring relationships Academic identity
	2014	Browning, Thompson &	Developing future research leaders.	Australia	Early career researchers Researcher development

		Dawson			Evaluation Research leaders Track record
Studies in Higher Education	2013	Gilmore, Maher, Feldon & Timmerman	Exploration of factors related to the development of science, technology, engineering, and mathematics graduate teaching assistants' teaching orientations.	US	Graduate teaching assistant Teaching orientation Teacher beliefs Graduate student education Graduate student development Graduate student mentoring
	2011	Lindén, Ohlin & Brodin	Mentorship, supervision and learning experience in PhD education.	Sweden	Mentorship PhD students PhD supervision Learning outcomes Professional development
	2010	Hopwood	Doctoral experience and learning from a sociocultural perspective.	UK	Doctoral education Doctoral practices Academic practice Sociocultural perspectives doctoral study
	2008	Kamler	Rethinking doctoral publication practices: writing from and beyond the thesis.	Australia	-
The Journal of Higher Education	2012	Noy & Ray	Graduate Students' Perceptions of Their Advisors: Is There Systematic Disadvantage in Mentorship?	US	-
	2009	Patton	My Sister's Keeper: A Qualitative Examination of Mentoring ExperiencesAmong African American Women in Graduate and Professional Schools	US	-
The Review of Higher Education	2014	Main	Gender Homophily, Ph.D. Completion, and Time to Degree in the Humanities and Humanistic Social Sciences.	US	-
	2013	O'Meara, Knudsen & Jones	The Role of Emotional Competencies in Faculty-Doctoral Student Relationships.	US	-

4. Results

As stated above, the main aim of this paper is to generate insight into the current academic literature on ECR mentoring; the findings are structured around the four research questions.

4.1 What is the range of ways in which ECR mentoring is defined or conceptually presented?

In order to answer this question, we first explored the nature of the articles, the gaps identified by the authors and the specific research questions in these papers, as these elements could be expected to be related to the conceptual frameworks and definitions authors had drawn upon in developing their research study.

Nature of articles: Our initial search of the journals confirmed Ehrich's (2004) outcome that while mentoring was frequently referred to, it was rarely *studied*. In fact, we found more articles that referred to mentoring than those which studied mentoring as the core business of their research project. Of the 23 articles that studied mentoring and formed the basis of the review, 19 were empirical studies, four (Mathias, 2005; Kamvounias et al, 2008; Hubball et al., 2010; Bell & Treveanor, 2011) of which evaluated programs that had a mentoring element. Four articles were non-empirical in nature (Baker et al., 2014; Cox, 2013; Saito, 2013; Weave et al., 2013).

Gap identified: In examining the 'gap' that the authors were attempting to address, we noted that a definitional representation of mentoring was rare. For instance, most of the studies addressing doctoral experience used as a starting point that the supervisor (referred to as advisor in the US) was equivalent to a mentor, though Baker et al. (2014) noted the ambiguity in the roles of supervisor, advisor, and mentor. So, while half of the studies explicitly named the 'gap' as the need to understand mentoring better, most appeared to assume a shared understanding of mentoring between authors and readers with the focus of each study mainly directed to a given situation in a specific context, e.g., support for teaching assistants.

Question/purpose: The research questions underlying the studies were formulated to answer question about (1) experiences of mentoring and (2) mentoring relationships. The bulk of the studies (Kamler, 2008; Patton, 2009; Hopwood, 2009; Lechuga, 2011; Baker et al., 2012; Noy & Ray, 2012; Gilmore et al., 2013; Linden et al., 2013; Main, 2014) addressed mentoring in the context of doctoral education, answering a wide range of research questions in relation to career advice, teaching and supervisory relationships. This group was followed by a substantial minority on mentoring related to teaching development with reference to ECRs, though not necessarily defining who they were in terms of their length of research or academic experience. Lastly, only one addressed postdoctoral experience (Scaffidi & Berman, 2011).

In general, across all papers reviewed, two main purposes were thus found. (1) Many articles focused on gaining better insight into the way ECRs *experience* mentoring and whether they get something out of it in terms of their own learning process and professional development. Examples include Patton's article (2009) on experiences of African American women in academia, Kamler's research (2008) on mentoring experiences in relation to academic writing, or Mathias' paper (2005) on specific mentoring experiences in relation to participation in the Postgraduate Certificate of Academic Practice (the UK's officially recognised Higher Education teaching qualification). (2) Another cluster of papers focused on the specific *relationships* that are being built between mentors and mentees. For instance, Lechuga (2011) focused on mentors' responsibilities and the relationships they built with faculty-graduate students. Kamvanious et al's research (2008) explored the idea of 'gifts' in mentoring, and how mentees want to give something back to their mentors. Research by O'Meara et al. (2013) explored the 'emotional landscape' of relationships between mentors/advisors and doctoral students.

Conceptual frame and core references: Having identified the nature, gaps and purposes of these articles, the next step was to explore the conceptual frameworks used by these authors. In general, conceptual framing of the studies in relation specifically to mentoring was minimal. Rather, papers tended to draw on general theories of learning and faculty development largely rooted in socio-constructivist

perspectives, e.g., communities of practice (Cox, 2013), learning (Linden et al., 2013), emotional competence (O'Meara et al., 2013), scholarship of teaching (Gilmore et al., 2013; Weave et al., 2013) or were firmly empirical (e.g. Mathias et al. 2005; Browning et al., 2014). Two empirical studies stood out for their efforts to frame mentoring: Van der Weijden et al. (2004) and Linden et al. (2013). Linden et al. (2013) used a typology of learning outcomes related to mentoring in the business context (Lankau and Scandura 2007). Van der Weijden et al. (2014) drew on the meta-analysis of mentoring programs in a range of fields referred to earlier (Ehrich et al, 2004). As well, Baker et al. (2014) in their conceptual paper proposed a model based on the notion of professional, relational and personal fit, rather than similarity, between student and supervisor. Given the diversity of stances taken in these studies, it was hard to discover a consistent pattern of common core references to conceptions of mentoring.

To conclude, as a general answer to this research question, the most striking finding of this analysis was a confirmation of the findings in the earlier non-higher education review (Ehrich et al., 2004): the generally under-conceptualized nature of mentoring in empirical studies on ECR experience. We would encourage researchers undertaking future studies of ECR mentoring to explicitly explore the value of different conceptual frameworks of mentoring, perhaps beginning with Erich et al.'s meta-analysis.

4.2 What methodological tools are used, i.e., the range of ways in which mentoring is measured?

In order to answer this research question, we explored the specific settings in which data were collected, by this we mean, the nature of the participants, their disciplines, the national location of the study, as well as the ways in which data were collected and analyzed, distinguishing principally between quantitative and qualitative methodologies.

Country/disciplines/participants: A majority of the papers represented research in English-speaking countries, with more in North America and Australia than in the UK. There were ten North American (nine US - Gilmore et al., 2013; Foote & Solem, 2009; Main, 2014; Noy & Ray, 2012; Baker et al., 2014; O'Meara et al., 2013; Cox, 2011; Lechuga, 2014; Patton, 2009, one Canada – Hubball et al., 2010); eight Australia and five EU (three in continental Europe: Sweden – Linden et al., 2013; The Netherlands – Van der Weijden et al. 2014; Estonia – Remmik, 2011); two in the UK (Mathias, 2005; Hopwood, 2010). As to disciplinary context, four focused on STEM fields (Scaffaldi & Berman, 2011; Gilmore et al., 2013; Van der Weijden et al., 2014; Lechuga, 2014), one focused specifically on humanist disciplines (Main, 2014) and the remainder represented participants from a range of disciplines, although most within social sciences.

Data collection/participants: As to the methods, qualitative and mixed methods were used more than solely quantitative studies. All, but one, of the quantitative studies were based on surveys, while Main (2014) conducted an analysis of pre-existing large data sets. As for the qualitative studies, the four papers evaluating programs used semi-structured interviews, student work, program documents and sometimes focus groups (Hubball et al., 2010; Bell & Treleaven 2011; Kamvounias et al., 2008; Mathias, 2005). The other qualitative studies were based on semi-structured interviews, with one also using focus groups, and another interviews over time (Kamler, 2008). Of the two mixed methods studies (Foote & Solem, 2009; Gilmore et al., 2013), one used interviews which were analyzed both quantitatively and qualitatively; the other used interviews, followed by a survey. Participant numbers in the qualitative studies tended to be quite small though Foote & Solem (2009) used focus groups with 46 ECRs and Hopwood (2010) 33 in focus groups and interviews. The quantitative studies also varied considerably in size from 86 (van der Weijden et al., 2014) to several thousands (Main, 2014).

As a general answer to this research question, we concluded that while a mix of qualitative and quantitative approaches were used, most studies (regardless of the methods) were based on one-time data collection with small numbers of participants. One study (Kamler, 2008) stood out in studying participant experience longitudinally which we view an innovative approach which might be emulated in future studies. Further, the tools used in the studies rarely were designed to capture experience related to the specific mentoring activities under study. We suggest future studies could develop tools to better capture the

experience of specific elements of mentoring. Lastly, the majority of studies were based on self-report; future research might move beyond this way of collecting data.

4.3 What evidence (or counter evidence) is there of the value of ECR mentoring?

Evidence of the value of mentoring was searched for in the results and conclusion sections of the papers under review. Apart from the nature of the results, we also explored the way in which they were formulated, in order to search for a conceptual representation of the results, which could form a strong conceptual basis for future research.

Findings: key findings (if any), conceptual representation of results

While most papers reported positive experiences and relationships in mentoring, it is important to recognise the influence of a range of factors on mentoring: e.g. Mathias (2005) concluded that mentoring provided within a postgraduate course resulted in several positive experiences, though much of the effect depended on the successful match between mentor and mentee. Still, given the research was undertaken in different contexts and within different disciplines, it is difficult to draw an overall conclusion which indicates either a positive or negative effect of mentoring. For example, Lechuga (2014) proposes that some mentoring relations that are acceptable in the social sciences may be considered "intrusive" in science and engineering. Still, at first sight, the cumulative results of these studies would appear to confirm the earlier non-higher education literature reviews: Eby et al. (2008) argued that the effects of mentoring seem quite small, and that mentoring does not always lead to positive experiences; Ehrich et al. (2004) that mentoring can, in fact, have negative consequences. Some authors, like Patton (2009) have already reflected on the lack of robust conceptual frameworks emerging from studies of mentoring, such as the emphasis on the paternal, male representation of mentoring and lack of critical studies on the topic. We agree that a more critical attitude is required among researchers in the field.

As a general answer to this research question, and as noted earlier, there was a stronger focus on the positive outcomes of mentoring rather than any negative ones. Given that the earlier reviews also noted this, a key aspect of any future research needs to be a careful seeking after possible negative effects as well as whether the effects are worth the time and money invested. To continue to propagate the notion that mentoring is important for ECR success without sufficient evidence seems counter-productive. Further analysis of both short-term and long-term effects of mentoring on ECR development as well as the existing challenges is recommended. Furthermore, apart from trying to position mentoring as something 'positive versus negative', it might be worthwhile to control for a wide range of other factors such as age, gender, subject, type of university, etc., in order to account for other direct or indirect effects of mentoring experiences and relationships.

4.4 To what extent does the literature point to future research?

The papers pointed towards the future in two ways. On the one hand, several papers made recommendations for future policy and practice, which were mainly concentrated around actions to increase the importance of mentoring and awareness of what good mentoring among mentors consists of. Both Foote and Solem (2009) and Gilmore et al. (2013) reflected on the notion of inclusiveness and involvement of mentors in their mentoring practices with students. Baker et al. (2014) recommended having more advanced reflections on the fit between doctoral students and the supervisor in order to increase the effectiveness of mentoring. As well, apart from reflecting on what needed to happen in future mentoring, some papers formulated recommendations for future research, such as the need for a better understanding of what is *causing* good mentoring (Kamvounias et al., 2008; Noy & Ray, 2012; O'Meara et al., 2013; Baker et al., 2014; Van der Weijden et al., 2014), as well as the need to enlarge research in terms of *countries and disciplines* (Patton, 2009; Bell & Treveaven, 2011). As a general answer to this research question, we

suggest there is room for conducting further research on mentoring, in a broader and more diversified way than it has been conducted until now.

5. Significance

We undertook this review to assess the state of the literature on ECR mentoring in the past 10 years, post-Ehrich (2004) review, to provide a base for future inquiry. We also wanted to consider possible policy implications since the EU has created an imperative for institutions to address the career development needs of post-docs/ early career researchers within the Bologna Strategy, the result of which has been a proliferation of institutional mentoring. We conclude there is much research still to be done that can better inform our conceptualization and implementation of ECR mentoring support and the development of mentoring programs. Below we make specific recommendations for future research drawn from our review.

A future research agenda

We suggest a key goal is a more robust conceptualisation of ECR mentoring including a well-defined representation of the learning process. It should include at a minimum, starting with the recommendations at the top of this list:

- Examine the theoretical awareness of mentoring (including organisational and individual obstacles) that exist among ECRs and their mentors. These findings would help to capture the complexity of ECR mentoring support.
- Study ECRs who are actively engaged in structuring informal learning situations that meet their specific needs at different times, and that as mentees they are free to choose one or more mentors. This fits with the idea of mentoring as support towards self-organisation and self-development, in which early career researchers gain the skills to grow towards independence (Gardner, 2008; Laudel & Glaser, 2008).
- Further examine the effects of mentorship relationships by looking at different elements of mentoring (especially the functions of mentoring), since there is evidence of some negative consequences related to the mismatch of expertise and/or personality (e.g. Ehrich et al. 2004).
- Seek evidence of how the literature on mentoring is connected with growing ECR confidence and competence as independent researchers and scholars; this would mean linking mentoring to the range of abilities essential for ECRs to develop in relation to research, teaching, management, leadership, intercultural skills, publishing, media use, and expectations regarding social engagement (e.g., Debowski, 2012).
- Explore the potential of a trans-organizational conceptualization of mentoring that addresses transfer across institutions and countries, as mobility and intercultural learning form important aspects of early career researcher experience today (Horta, 2009).
- Consider ways to link mentoring for ECR development to other fields including education (not higher education), business and medicine (Ehrich et al., 2004) in order to build up the required resource base and decide on suitable strategies and benchmarks.
- Examine organizational measures for supportive mentoring systems by integrating formal learning with informal mentoring to support cooperation between less and more experienced researchers and thus encourage collegial relationship across scholarly communities in activities such as publishing, research organization, data collection.

This review analysis was conducted post-Ehrich review, exploring the period from 2005 to 2014. Overall, we consider Ehrich et al.'s earlier assessment of the education and business reports on mentoring programs to still hold true – the need to: a) attend to mentors' experiences - our analyses showed a relatively weaker focus on mentors, and implied the need to examine both mentees and mentors' experiences ; b) pay

more attention to negative outcomes - few authors reported negative outcomes of mentoring, and it is necessary to understand how the system malfunctions in those cases ; c) move beyond the data that have generally been collected (self-report process data) - for example, observation approaches have not been used in our articles reviewed - and seek evidence of impact on actual behaviour performance. And, in order to assess the value of mentoring, attention should be given to opportunities to collect longitudinal data.

Keypoints

- More research is recommended to better inform the conceptualization of mentoring
- A future research agenda needs to explore formal as well as informal aspects of mentoring
- It would be recommended to explore mentoring using a range of research methods

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